Claims

1. *(Currently amended)* An antiferromagnetically exchange-coupled structure in a magnetic device of the type having a substrate and a plurality of ferromagnetic layers, the structure being formed on the substrate and comprising:

an underlayer formed of a substantially-chemically-ordered alloy having a tetragonal crystalline structure, the alloy selected from the group consisting of alloys of AuCu, FePt, FePd, AgTi3, Pt Zn, PdZn, IrV, CoPt and PdCd, said underlayer alloy further comprising at least one element selected from the group consisting of Pd, Fe, Pt, and Rh;

an antiferromagnetic layer in contact with the underlayer and formed of a substantially-chemically-ordered alloy comprising X and Mn and having a tetragonal crystalline structure, wherein X is selected from the group consisting of Pt, Ni, Ir, Pd and Rh; and

a ferromagnetic layer exchange-coupled with the antiferromagnetic layer.

2. *(Original)* The structure of claim 1 further comprising a seed layer consisting essentially of Ru or Rh, the underlayer being located on the seed layer.

3. (Canceled)

4. *(Original)* The structure of claim 1 wherein the antiferromagnetic alloy further comprises one or more of Cr, Pt, Pd, V and Ni.

5. *(Original)* The structure of claim 1 wherein the first element listed in each underlayer alloy in the group is present in the alloy in amount between approximately 35 and 65 atomic percent.

6. *(Original)* The structure of claim 1 wherein the underlayer alloy comprises Au and Cu and the antiferromagnetic alloy comprises Pt and Mn.

7. *(Original)* The structure of claim 6 wherein the thickness of the PtMn alloy antiferromagnetic layer is less than approximately 125 Angstroms.

8. *(Original)* The structure of claim 7 wherein the thickness of the AuCu underlayer is between approximately 10 and 200 Angstroms.

9. *(Currently amended)* A magnetoresistive read head for sensing data recorded on a magnetic recording medium in the presence of sense current through the head, the head comprising:

a substrate;

an exchange-coupled structure on the substrate and comprising (a) an underlayer formed of a substantially-chemically-ordered alloy having a tetragonal crystalline structure, the alloy selected from the group consisting of alloys of AuCu, FePt, FePd, AgTi3, Pt Zn, PdZn, IrV, CoPt and PdCd, said underlayer alloy further comprising at least one element selected from the group consisting of Pd, Fe, Pt, and Rh; (b) an antiferromagnetic layer in contact with the underlayer and formed of a substantially-chemically-ordered alloy comprising X and Mn and having a tetragonal crystalline structure, wherein X is selected from the group consisting of Pt, Ni, Ir, Pd and Rh; and (c) a pinned ferromagnetic layer exchange-coupled with the antiferromagnetic layer and having a magnetization direction oriented substantially perpendicular to the plane of the recording medium and substantially prevented from rotating in the presence of magnetic fields from the recording medium;

a free ferromagnetic layer having a magnetization direction oriented substantially parallel to the plane of the recording medium in the absence of an external magnetic field, said free layer magnetization direction being substantially free to rotate in the presence of magnetic fields from the recording medium; and

a nonmagnetic spacer layer between the pinned ferromagnetic layer and the free ferromagnetic layer.

10. *(Original)* The head according to claim 9 wherein the free layer is located between the substrate and the exchange-coupled structure.

11. *(Original)* The head according to claim 9 wherein the head is a current-in-the-plane head having the sense current directed substantially parallel to the plane of the free layer.

12. *(Original)* The head according to claim 9 wherein the head is a current-perpendicular-to-the-plane head having the sense current directed substantially perpendicular to the plane of the free layer.

13. *(Original)* The head according to claim 12 wherein the head is a spin-valve head and wherein the nonmagnetic spacer layer is electrically conducting.

14. *(Original)* The head according to claim 12 wherein the head is a magnetic tunnel junction head and wherein the nonmagnetic spacer layer is an electrically- insulating tunnel barrier.

15. *(Original)* The head of claim 12 further comprising a seed layer consisting essentially of Ru or Rh, the underlayer being located on the seed layer.

16. (Canceled)

17. *(Original)* The head of claim 12 wherein the antiferromagnetic alloy further comprises one or more of Cr, Pt, Pd, V, and Ni.

18. *(Original)* The head of claim 12 wherein the first element listed in each underlayer alloy in the group is present in the alloy in amount between approximately 35 and 65 atomic percent.

19. *(Original)* The head of claim 12 wherein the underlayer alloy comprises Au and Cu and the antiferromagnetic alloy comprises Pt and Mn.

20. *(Original)* The head of claim 19 wherein the thickness of the PtMn alloy antiferromagnetic layer is less than approximately 125 Angstroms.

21. *(Original)* The head of claim 20 wherein the thickness of the AuCu underlayer is between approximately 10 and 200 Angstroms.

22. *(New)* A current-perpendicular-to-the-plane (CPP) magnetoresistive read head for sensing data recorded on a magnetic recording medium in the presence of sense current directed substantially perpendicular to the planes of the layers making up the head, the CPP magnetoresistive read head comprising:

a substrate;

an exchange-coupled structure on the substrate and comprising (a) an underlayer formed of a substantially-chemically-ordered alloy comprising Au and Cu and having a tetragonal crystalline structure and having a thickness between about 10 and 200 Angstroms; (b) an antiferromagnetic layer in contact with the underlayer and formed of a substantially-chemically-ordered alloy comprising Pt and Mn and having a tetragonal crystalline structure and a thickness less than approximately 125 Angstroms; and (c) a pinned ferromagnetic layer exchange-coupled with the antiferromagnetic layer and having a magnetization direction oriented substantially perpendicular to the plane of the recording medium and substantially prevented from rotating in the presence of magnetic fields from the recording medium;

a free ferromagnetic layer having a magnetization direction oriented substantially parallel to the plane of the recording medium in the absence of an external magnetic field, said free layer magnetization direction being substantially free to rotate in the presence of magnetic fields from the recording medium; and

a nonmagnetic spacer layer between the pinned ferromagnetic layer and the free ferromagnetic layer.

23. *(New)* The head of claim 22 wherein the thickness of the PtMn alloy antiferromagnetic layer is between approximately 25 and 50 Angstroms.